

UNITED STATES DEPARTMENT OF AGRICULTURE  
FOREST SERVICE

ESTABLISHMENT AND PROGRESS OF  
THE PRIEST RIVER ARBORETUM, 1931 to 1936

By

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Senior Silviculturist



October 19, 1937

NORTHERN ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION  
MISSOULA, MONTANA

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Introduction

The idea of starting the present arboretum at the Priest River Experimental Forest was conceived in 1929. The area was selected and a topographic map was made at that time. Site conditions were mapped and preliminary subdivision into blocks by genera and species was made in 1930 and 1931. Planting was started in 1931.

The aims of the arboretum are: (1) to test the growth and adaptability of indigenous and exotic species having a reasonable prospect of growing under the climatic conditions of northern Idaho; (2) to test such trees for the possibility of timber growing, watershed, or other forest uses and for research and educational purposes; (3) to grow each species in blocks large enough so that they will form a small example of forest stand conditions at maturity rather than to have ultimately only a few specimen trees of each species.

Those chiefly connected with the arboretum work to date have been the author, who conceived and planned the project and directed its progress; J. B. Thompson, who during his incumbency as superintendent of the Priest River Experimental Forest attended to the mapping, clearing, fencing, setting of posts, and much of the planting and making of survival counts; Peter Hirst, CCC foreman and local resident, who has actively participated for more than 5 years in the actual setting of trees, staking, and making of annual examinations.

#### Area and Natural Features

The total area available for the arboretum is about 200 acres, located about  $1\frac{1}{2}$  miles from the Experiment Station buildings and chiefly in the  $W\frac{1}{2}$  of Section 34, T 58 N, R 4 W, Boise meridian. About 100 acres of this area, located in the  $SW\frac{1}{4}$  of Section 34, was selected for the first stage of development now in progress. This is chiefly to the east and north of the present CCC camp. The timber was cut about 20 to 25 years ago and the ground burned over several times in the following years. Since the area was selected for the arboretum, most of the ground has been cleared by felling of snags and burning of slash by CCC and ERA workers.

The elevation ranges from 2,200 to 2,400 feet. About half of the area is a level bench 50 feet above Priest River and half is gentle to steep slopes. Most of the sloping ground faces west, some faces north, and a small amount faces south.



The soil is mostly a deep, fine sandy loam. It is well-drained except in the southeast portion of the area, where there is about 8 acres of bench land adjacent to the foot of the slope which is marshy and dries out only in the driest summers. The vegetation in this area is characterized by alders and to some extent by cat-tails.

#### Mapping, Subdivision, and Allocation of Species

A topographic map was made with contour intervals of 5 feet. For the 100-acre area to be planted and developed first a classification was made as to site conditions, chiefly from the standpoint of relative soil moisture. On the basis of this classification allocation of genera and species was made, following which the area was subdivided into blocks of approximately one-quarter to one acre in size. White painted cedar corner posts were placed at the corners of these blocks. The pines and spruces were allocated to the well-drained parts of the bench, the larches to the west slopes, the junipers to the drier west and south slopes, the cedars and moisture-loving spruces to the marshy ground, and the true firs and hemlocks to the north slopes and colder sites. This portion of the arboretum provides space for most of the conifers in these genera that will grow in northern Idaho. For additional planting of conifers and for hardwoods, undeveloped ground to the north of this area and west of the county road is available. As early experimental planting of hardwoods at the Station met largely with failure, it is planned to proceed rather cautiously with the introduction of hardwoods in the arboretum.



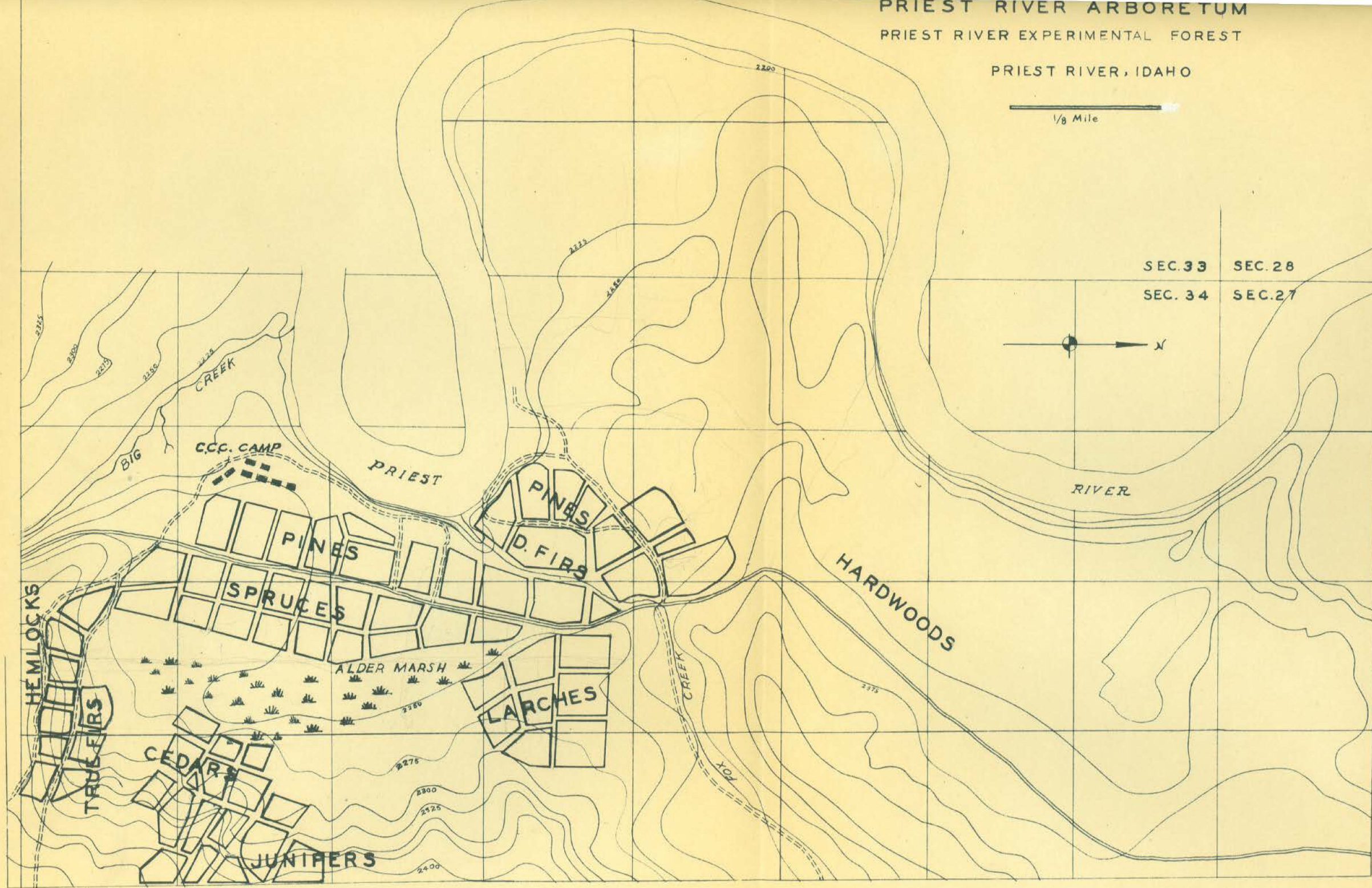
PRIEST RIVER ARBORETUM

PRIEST RIVER EXPERIMENTAL FOREST

PRIEST RIVER, IDAHO



SEC. 33    SEC. 28  
SEC. 34    SEC. 27





## Climate

The area is located in latitude 48°20' north and longitude 116°50' west. The climate is typical of the western white pine forest with ample fall, winter, and spring precipitation conducive to luxuriant forest growth. July and August are characteristically hot and dry. Climatological records have been taken continuously since 1912 at the Priest River Station. The following summary of climatic data<sup>1/</sup> will be found useful in comparing with the native climate of proposed exotics to ascertain their possibilities of adaptation.

Precipitation. The mean annual precipitation for the years 1912 to 1935, inclusive, is 28.70 inches. The maximum annual precipitation (1927) was 41.34 inches and the minimum (1929) was 16.02 inches. The longest period without rain (1912-31) was 43 days. The mean annual snowfall (1912-31) is 82.8 inches. The maximum depth of snow on the ground at one time was 37.0 inches and occurred in 1913.

The following figures represent the average monthly rainfall in inches (1912-35) and the actual monthly rainfall for the individual months April to September for the period since planting has been in progress:

	<u>Average</u> <u>1912-35</u>	<u>1931</u>	<u>1932</u>	<u>1933</u>	<u>1934</u>	<u>1935</u>	<u>1936</u>
April	1.89	1.32	3.63	.64	1.78	.64	.98
May	1.95	1.10	3.01	1.49	1.47	.72	1.36
June	1.68	1.55	.84	1.97	.75	1.28	2.31
July	.80	.49	.48	.08	.04	1.36	.59
August	1.07	T	.41	.29	.08	.69	.73
September	1.70	2.10	.50	2.28	.81	.50	2.84

<sup>1/</sup> Taken largely from mimeographed report "Climatological Summary for the Priest River Forest Experiment Station, 1912-1931, Inclusive," by George M. Jenison.

These figures indicate the excessive July-August drought of the consecutive years 1931-34. In only 5 other summers in 25 years was the total July-August rainfall less than 1 inch, viz., in 1917, 1922, 1923, 1925 and 1929. In the remaining 16 years of record the total rainfall for these 2 months has ranged from 1.56 to 5.26 inches.

Temperature. The mean annual temperature (1912-35) is 43.3° F. The absolute maximum was 102° in 1924 and the absolute minimum was -35° in 1933. The average length of the frostless season, i.e., the period without a temperature of 32° or lower, is 62 days. The range of the frostless season has been 5 to 116 days. The latest frost on record has been July 27 and the earliest August 13. The approximate average date of the first daily mean temperature of 40° is April 5. This figure is used by some ecologists as the temperature necessary for tree growth to take place.

The following are the monthly mean temperatures in degrees Fahrenheit for the months indicated, covering the years 1912-31: April, 43.3; May, 51.2; June, 57.9; July, 63.8; August, 62.6; September, 53.2.

Relative Humidity. July has the lowest average monthly relative humidity at 5 p.m., 37.1 percent, but August 1931 established a record low average monthly figure of 22 percent. The absolute lowest 5 p.m. relative humidity was 8 percent on July 26, 1931. The years covered by these figures are 1912 to 1931.



Evaporation. Average daily evaporation for July and August (1922-31) is 10.61 grams, according to measurements with the Type No. 4 Bates "sun" evaporimeter.

Wind. The average monthly wind movement (1912-31) is 1.63 miles per hour. The windiest month is April, with an average of 2.20 miles per hour, and the least windy month is November, with an average of 1.10 miles per hour.

Soil Temperature. The average of daily soil temperature readings in degrees Fahrenheit on flat ground practically bare of vegetation are as follows for the years indicated:

<u>Depth</u>	<u>April</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Period</u>
6 inches	43.1	52.7	61.0	66.4	67.0	57.0	1913-17
12 inches	40.8	49.3	56.3	60.8	60.9	55.2	1912-31
24 inches	40.4	46.5	52.7	56.9	58.7	54.4	1912-16

#### Growing Season

It is common belief that the growing season is delimited by the last and first frosts of the year, or that it coincides with the period during which the mean air temperature is above 40° F. Neither of these rules of thumb applies to northern Idaho. Severe frosts may occur in any one of the summer months and the average frostless season is actually only 62 days. The period with average temperature above 40° embraces about 205 days and extends approximately from April 5 to October 26.

The best index of the limits of the growing season would seem to be the actually observed dates of beginning and ending of vegetative activity. Accordingly, phenological observations made at the Priest River Station for 7 years (1928, 1929, 1930, 1931, 1933, 1934, 1936) are here used. The observations

included among other things the beginning of cambium growth and the bursting of shoot and leaf buds. As the start of cambium growth (observed by slipping of the bark on the wood due to the cambial cells becoming liquid at this time) was found to precede the bursting of buds, this activity is taken as marking the beginning of growth above ground. As the time when the bark "sticks" was observed to follow the formation of winter buds and ending of shoot growth, it was taken as marking the end of growth for the season. Superintendent J. B. Thompson, a careful and competent observer, personally made most of the phenological observations.

The following tabulation gives for eight species the earliest and latest dates of beginning and ending of diameter growth (cambium activity) and the average dates for the seven years of record. These figures represent the average of observations at two stations, one in a mature stand and one in a sapling stand, both immediately adjacent to the arboretum.

From these observations on eight native species, it would seem safe to conclude that the growing season at the site of the arboretum begins on the average between April 16 and 22 and ends between July 31 and August 10, and has a length of approximately 105 to 113 days. This information will be vitally important in explaining frost injury, slow growth, or other erratic behavior of introduced species whose inherited vegetative periods may be shorter or longer, and whose beginning and ending dates may vary from those here shown.

Phenological observations indicating the growing season

Species	Observation	Beginning of diameter growth Date	Ending of diameter growth Date	Interval : or average growing season Days
Western white pine	Earliest date	April 12	July 21	
	Latest date	April 25	Aug. 29	
	Average date	April 19	Aug. 9	113
Ponderosa pine	Earliest date	April 6	July 10	
	Latest date	April 27	Aug. 21	
	Average date	April 17	Aug. 6	112
Lodgepole pine	Earliest date	April 1	July 21	
	Latest date	April 27	Aug. 16	
	Average date	April 16	July 31	107
Western larch	Earliest date	April 9	July 15	
	Latest date	April 25	Aug. 26	
	Average date	April 18	Aug. 3	108
Lowland white fir	Earliest date	April 8	July 15	
	Latest date	April 29	Aug. 24	
	Average date	April 22	Aug. 8	109
Douglas fir	Earliest date	April 14	July 23	
	Latest date	May 6	Aug. 28	
	Average date	April 22	Aug. 10	111
Western hemlock	Earliest date	April 7	July 18	
	Latest date	May 3	Aug. 21	
	Average date	April 20	Aug. 6	109
Engelmann spruce	Earliest date	April 15	July 23	
	Latest date	May 6	Aug. 16	
	Average date	April 22	Aug. 4	105



### Obtaining Planting Stock

As Savenac Nursery has been able to furnish only a small amount of specially grown nursery stock in addition to the few native species grown for extensive planting purposes, it has been necessary to order stock from Federal and State forest nurseries throughout the United States wherever the desired species could be obtained. In this way, stock for 35 or 40 species has been obtained so far from about 15 nurseries from the Atlantic to the Pacific Coasts. Stock for about 10 species has been obtained from Savenac Nursery.

### Planting to Date

The planting plan has been to get as nearly a full stand as possible and to do this by replanting of fail places. Thus, the practice has been to order about twice as much stock as a given block has required for first planting. The excess stock has been planted in transplant beds in a small hold-over nursery of about .2 acre, located near the Station buildings. Planting of fail spots in the arboretum has been done the first and second year, or until the stock has been exhausted. In several cases, due to extremely heavy losses, additional new stock has been ordered from nurseries. The spacing of the trees has been mostly 6 x 6 feet. A special effort has been made to get careful setting and tamping of the roots and to prepare sod-covered ground by scalping. The planting tools used have been short- and long-handled mattocks with 10-inch blades.

Four blocks were planted in 1931, three in 1932, seventeen in 1933, five in 1934, eighteen in 1935, and two in 1936. Replanting to various degrees has been done in nearly all of these blocks. Each tree has been marked by an individual stake  $1\frac{1}{2}$  x  $1\frac{1}{2}$  inch, driven into the ground to a height of about one foot. The corner posts of the blocks were painted and aluminum labels designating the species were attached.

### Survival Difficulties

Because the years 1931 to 1935 cover a notable drought period, with 1933 and 1934 among the driest summers on record, drought losses have been discouragingly heavy. The exceedingly thick sod that has developed during 20 years on part of this old cut-over area has also been a serious cause of loss of planted trees. Additional causes of loss have been frost heaving, rodent destruction, and to some extent, poor condition of stock due to early lifting in nurseries in parts of the country where the season is much in advance of that at Priest River. In the case of European larch stock from Corvallis, Oregon, for example, the trees had already started shoot and leaf growth when they reached the Station. In other cases, the stock had dried out somewhat in transit, due to careless packing or delays in shipment. First-year losses of stock planted in 1933 ranged from 12 to 90 percent. Of stock planted in 1934 the first-year losses were from 10 to 40 percent. In a few cases of extremely drought resistant species, like the junipers, first-year losses were only 5 to 10 percent. In an effort to combat the losses from drought, planted trees were

shaded with discarded shingles, of which a great abundance has been available through extensive reconstruction of buildings at the Station. The shingles helped only slightly in the years of extreme drought. Where they were not removed or reset after being mashed down by the snow, they were in some cases the cause of losses due to smothering. To combat the heavy sod, wide scalping was done in the more recent planting. This aided considerably in survival, but should be followed up with one or two years of cultivation because of the aggressive reinvasion of the grass on these spots. To overcome the rodent losses, which are mainly in the form of covering and smothering of plants by excavations of Columbia ground squirrels and pocket gophers, the arboretum area has been poisoned at intervals of one or two years. The rodent control measures, however, are still not intensive or effective enough to give relief from this form of damage.

#### Periodic Examinations

The plan has been to make annual counts of dead and live trees for the first 3 to 5 years following planting and thereafter to make such counts at 3- or 5-year intervals. As height growth is slow in starting in this locality, the plan has been not to begin making height measurements until the fifth year and then to repeat them at 5-year periods. At such intervals, the total height and the height of each node can be measured back to the point measured at the previous time of measurement. It is planned to make exceptions to this procedure in the case



of certain fast-growing species which develop adventitious branches between the annual nodes like Pinus banksiana, P. sylvestris, and P. contorta. As the Pinus banksiana trees already showed heights of 1½ to 5½ feet in the third year after planting (much the fastest growth of any species in the arboretum), height measurements were started on this species at that time. To prevent this work becoming too great a labor, height measurements on the species developing adventitious branches might be made every 2 years.

A form has been designed to record the results of survival counts and to show also the dates of planting and replanting, the source of stock, and other pertinent information. A copy of this is found in the appendix to this report. The essential records to date have been compiled in the form of a tabulated summary which is also presented in the appendix. This shows for each species the year of first planting, the number of trees alive in 1936, the capacity of the block, the condition of the trees, and the recommended action as to whether fail places should be planted in the entire block, or whether the block should be reduced in size and the existing surviving plants concentrated in it by moving them by careful transplanting. A more comprehensive table for compilation and planning purposes should be prepared in which to assemble for each species such information as origin of seed, nurseries where stock was raised, the year and number of trees planted in the original planting and at each replanting, total planted

to date, number and percent alive at given dates, condition and remarks as to future action. A proposed form with partially compiled records is included in the appendix.

### Species Proposed for Planting<sup>2/</sup>

As already indicated, the plan has not been to test exotic species indiscriminately, but to plant only those species which give promise of survival in northern Idaho after comparing the climate of origin with the local climate. For this reason, the following rather tentative list is not very extensive. There will doubtless be additional trees which should in time be considered for trial. Because northern Idaho is almost exclusively a region of conifers, and because of early failures with hardwoods,<sup>3/</sup> only a limited number of hardwood species are listed, and it is suggested that planting of them be done very cautiously. The trees which have already been planted in the arboretum are indicated by the degree sign.

*Pinus monticola*°  
  *strobis*°  
  *strobiformis*  
  *flexilis*°  
  *albicaulis*  
  *lambertiana*°  
  *peuce*°  
  *excelsa*  
  *cembra*  
  *cembra v. sibirica*  
  *koraiensis*  
  *armandi*  
  *parviflora*  
  *ponderosa*°  
  *jeffreyi*°  
  *attenuata*°

*Pinus leucodermis*  
  *resinosa*°  
  *rigida*°  
  *contorta*°  
  *banksiana*°  
  *pungens*  
  *sylvestris*°  
  *sinensis*  
  *montana*°  
  *austriaca*°  
  *aristata*°  
  *edulis*°  
  *monophylla*  
  *balfouriana*  
  *bungeana*  
  *funbris*

<sup>2/</sup> Handbook of Coniferae by Dallimore and Jackson is a useful reference for nomenclature, botanical description, and climatic requirements of the conifers of the world.

<sup>3/</sup> See manuscript planting reports by J. A. Larsen in Station files on results of early trials of hardwoods.

<b>Larix occidentalis°</b>		<b>Picea engelmanni°</b>
laricina		canadensis°
lyallii		pungens°
europaea°		sitchensis°
eurolepis		breweriana
leptolepis°		rubra°
dahurica		mariana°
kurilensis		excelsa°
sibirica		glehni
principis rupprechtii		jezoensis
		koyamai
<b>Tsuga heterophylla°</b>		likiangensis
canadensis°		morinda
mertensiana°		orientalis
sieboldi		omorika
		obovata
<b>Pseudotsuga taxifolia (Colo.)°</b>		<b>Abies balsamea°</b>
taxifolia (Mont.)°		fraseri
taxifolia (Wash.)°		lasiocarpa
macrocarpa		grandis°
		concolor
<b>Cupressus arizonica°</b>		nobilis°
macnabiana°		amabilis
		arizonica
<b>Chamaecyparis lawsoniana°</b>		magnifica°
nootkatensis		magnifica v. shastensis°
thyoides		brachyphylla
obtusa		firma
pisifera		holophylla
		koreana
<b>Juniperus scopulorum°</b>		nephrolepis
occidentalis		nordmanniana
virginiana°		pectinata
monosperma		sachalinensis
utahensis		veitchii
pachyphloea		sibirica
communis		
communis v. alpina		<b>Thuja plicata°</b>
horizontalis		occidentalis°
sabina		orientalis°
semiglobosa		japonica
		dolabrata
<b>Taxus brevifolia</b>		<b>Libocedrus decurrens°</b>
canadensis		chilensis
bacata		
cuspidata		



Betula	papyrifera v. occidentalis	Ulmus	americana°
	papyrifera v. subcordata		racemosa
	papyrifera v. montanensis		fulva
	fontinalis		pumila°
	fontinalis v. piperi		parvifolia
Acer	glabrum	Fraxinus	americana
	grandidentatum		nigra
	saccharum		pennsylvannica
	saccharinum		pennsylvannica v. lanceolata°
	rubrum		
	negundo°	Alnus	sinuata
	platanoides		tenuifolia
			rhombifolia
Populus	trichocarpa	Sorbus	americana
	balsamifera		americana v. sitchensis
	deltoides		acuparia
	sargentii		
	angustifolia	Quercus	garryana
	accuminata		macrocarpa
	tremuloides		borealis
	grandidentata		pedunculata
	alba		
	alba v. bolleana	Tilia	americana
Salix	amygdaloides	Celtis	douglasii
	lasianandra		occidentalis
	exigua		
	mackenziana	Rhamnus	purshiana
	bebbiana		
	scouleriana	Caragana	arborescens°
Prunus	emarginata	Elaeagnus	angustifolia°
	demissa		
	demissa v. melanocarpa		

### General Results and Conclusions

The summary table shows for the 50 or more species so far planted the number alive and their present condition.<sup>4/</sup> Although it is early to comment on the adaptability of the various species, a brief statement of the outstanding cases of good survival and of failure will indicate the possibilities.

<sup>4/</sup> See mimeographed report entitled "The Wind River Arboretum from 1912 to 1932" by Thornton T. Munger and Ernest L. Kolbe, Pacific Northwest Forest Experiment Station, for results of longer trials with these and many other coniferous species.

Pinus peuce, the 5-needled white pine from Macedonia, seems to have established itself remarkably well. As is characteristic of most white pines, its early growth has not been rapid, but survival is high and the trees are vigorous despite the heavy sod of its planting site. This is of particular interest because this species is said to be blister rust resistant. Pinus monticola and P. strobus have shown very low survival due to extremely heavy sod and drought. Both species will do well if planted in a favorable year, and if the sod is scalped and the trees are given some help by cultivation where necessary. Among the 2-needled pines, Pinus banksiana has made the best showing, this species, up to this time having made the most rapid growth of any in the arboretum. Some of the taller individuals, however, are crooked by reason of having been bent over by the wet snow of this region. Pinus ponderosa has produced vigorous trees, but because of the exceedingly dry conditions in the years of planting, losses were rather heavy. Pinus jeffreyi has about 260 surviving trees that are vigorous and give every appearance of being established. All the trees of Pinus attenuata have died and only a few of those of Pinus lambertiana are still alive. Of the spruces, Picea engelmanni, P. pungens, P. canadensis, P. mariana, and P. excelsa have done well after becoming established, although there were very heavy drought losses among all of them, particularly P. excelsa and P. engelmanni. Picea rubra and P. sitchensis have a low survival and the survived trees have been badly frosted. Very low survival so far has

been the rule among species of Abies, Tsuga, Thuja, and Chamaecyparis. All the trees of Cupressus arizonica and C. macnabiana died. Juniperus scopulorum and J. virginiana have given the best early survival of any species in the arboretum.

The plan to date, in the case of all species well adapted to the locality, has been to fill out by replanting all losses due to the severe drought conditions of the past years. It is believed that the original plan should be followed in such cases of establishing sizable blocks in which forest stand conditions will be started. In the case of species which apparently can be established only under considerable difficulties, it is now believed desirable to reduce the size of the blocks and to consolidate the existing plantings by moving the survivors by careful shovel and ball earth methods. The blocks for which such action is recommended are indicated in the summary table.

Although the method of obtaining stock from different nurseries throughout the country is not entirely satisfactory, there does not seem to be any good alternative. In some cases, seed for desired species has been collected or purchased and the stock has been raised at Savenac Nursery. This has not proven altogether satisfactory, because the nursery can give only incidental attention to small special lots of trees of this sort. Under the set-up at the Priest River Station to date, there has been no provision for raising such stock there,



although that could very readily be done if there were someone there to give part-time attention to the sowing of the seed and the care of the nursery beds.

In addition to the number of trees required to establish the large-sized arboretum blocks of one-quarter to one acre, smaller lots of trees have been ordered in the case of species regarding which there has been some doubt as to survival in northern Idaho. Among such species, where from 10 to 200 nursery plants were added, were the following: Larix dahurica, L. kurilensis, Chamaecyparis nootkatensis, Abies pectinata, A. arizonica, A. holophylla, A. veitchii, A. koreana, A. nephrolepis, Pinus densiflora, P. sinensis, and P. tabulaeformis. Among the species where seed was ordered, or obtained by exchange, for raising small lots of trees at Savenac Nursery were the following: Pinus cembra v. sibirica, P. koraiensis, P. parviflora, P. thunbergii, Abies pinsapo, Picea omorika, P. obovata, Tsuga diversifolia, Juniperus communis, J. chinensis. Some of the stock thus received or raised was planted in the arboretum and some in the hold-over nursery at Priest River, and some is still in seed beds at Savenac Nursery. Because of the extreme drought conditions of recent years and because of the little attention that could be given to the growing of the special lots of seed at Savenac Nursery, very little in the way of definite conclusions is available as to the possibilities of establishment of these species. All of them were selected because of possible suitability to the region according to

similarity of climate of the place of origin as compared with northern Idaho. The present conditions of all these small lots should be followed up and those species that show indications of adaptability should be tested in quantity in the arboretum. The exotic white pines, particularly Pinus cembra v. sibirica because of its good lumber quality and possible blister rust resistance, should be tried.

One of the difficulties in starting the Priest River arboretum has been the inability to schedule time for giving attention to the work adequately. The job has for the most part been done as incidental to other work. The accomplishment to date is largely due to the personal interest and attention given to the actual work on the ground by J. B. Thompson and Peter Hirst. The arboretum need not be more than a minor project. To keep it going, a small amount of time and funds should definitely be scheduled each spring for planting and each fall for examinations. The spring work should not require more than two weeks on the part of a planting foreman and a crew of 4 or 5 planters, and the fall examinations not more than 4 or 5 days for 1 or 2 men. Some member of the technical staff who is distinctly interested in the subject should be responsible for the project, particularly for ordering the stock, designating the planting sites, and compiling the records. The plan for the future should include adequate protection against fire, diseases, insects, rodents, livestock, and trespassers. Protection against blister rust is already provided by the office of Blister Rust Control, but infection of pines

anywhere in the vicinity should be looked for constantly. Rodent control has been in progress, but as indicated above, is not as effective as might be expected. Every effort should be made to improve the rodent control measures. Livestock is now excluded by fences. Trespassers will have to be considered when spruces and firs reach Christmas tree size. In the earlier plantings of the Experiment Station such trees have been cut and stolen on several occasions.

As a part of the work in the future, definite plans should be made to take repeat photographs at intervals of perhaps 5 years.

One of the ill effects in replanting fall places to date has been the introduction of trees of different seed origin in later replantings after stock in the hold-over nursery was exhausted. Thus, in the case of some species like Norway spruce, Scotch pine, and a few others, stock has come from as many as three nurseries. Therefore, there are likely to be trees of different strains in a given block which will have different growth habits due to their hereditary racial differences. Except in cases of a succession of drought years, this difficulty should ordinarily not occur in the future if two or three times as much stock is ordered as needed in the first planting of the block.

The plan so far has not been to make the arboretum a testing ground for provenance studies. Such studies with racially different progenies of the same species require a great deal of care and are better handled as a separate project



like the Station's project devoted to geographic races of ponderosa pine. The arboretum, however, does have three races of Douglas fir in the blocks allocated to the local, Coast, and Colorado forms of this species.

An activity that should sometime be started in the arboretum is the making of simple phenological observations. The answer to the question why introduced trees are not hardy or are slow in growth is often found directly in the time of beginning and ending and the duration of their vegetative activity. Such habits are definitely known to be inherited. For example, trees that are accustomed to bursting their buds three or four weeks before local species may continually be frosted back and may be deformed or die because of this. Trees that have a short period of vegetative activity in their native habitat or one that does not conform to the period of growth in northern Idaho cannot for this reason make rapid or effective growth.

Although the arboretum has suffered discouragingly heavy losses as a result of having been started during an extended drought period, there is no reason to believe that success will not ultimately be possible through planting in favorable years and through persistence in improving planting methods and controlling the causes of mortality, and in getting nursery stock on the ground in good condition. The result in the form of a field laboratory of growing trees of many species and genera for research and demonstration purposes will greatly repay the effort.

# APPENDIX

## Summary of Status of Priest River Arboretum as of 1936<sup>1/</sup>

Species	: : Year : of first: : planting:	: Number: : alive : fall : 1936	: 2/ : Capacity: : of : block	: : Condition	: : Recommended action
Pinus ponderosa	: 1931	: 515	: 1200	: Good	: Fill in fail spots
jeffreyi	: 1933	: 266	: 1200	: "	: Consolidate
attenuata	: 1933	: none	: 1200	: All died	: Eliminate
resinosa	: 1933	: 449	: 1200	: Fair	: Consolidate
austriaca	: 1933	: 437	: 1200	: $\frac{1}{2}$ good - $\frac{1}{2}$ poor	: "
rigida	: 1933	: 275	: 500	: Fair	: "
sylvestris	: 1932	: 193	: 800	: "	: Fill in
banksiana	: 1932	: 453	: 800	: "	: "
contorta	: 1933	: 752	: 1200	: Fair to good	: "
montana	: 1933	: 337	: 1200	: "	: Consolidate
monticola	: 1931	: 417	: 1200	: Fair to poor	: Fill in, cultivate
strobilus	: 1931	: few	: 1200	: Poor. Heavy sod	: Replant, cultivate
flexilis	: 1933	: 259	: 1000	: Fair	: Fill in, cultivate
lambertiana	: 1933	: few	: 1000	: Poor	: Consolidate to 1/10 acre
peuce	: 1933	: 371	: 1200	: Good	: Fill in, cultivate
aristata	: 1935	No report:	: 1200	: No report	: -----
edulis	: 1935	: " "	: 500	: " "	: -----
densiflora	: 1933	: none	: 800	: All died	: Eliminate
Pseudotsuga	:	:	:	:	:
taxifolia (Mont.)	: 1934	: 488	: 1000	: Good	: Fill in
taxifolia (Colo.)	: 1933	: 242	: 1000	: Poor	: Consolidate
Taxifolia (Wash.)	: 1933	: 35	: 800	: Fair	: Consolidate to 1/10 A--replant
Picea excelsa	: 1932	: 93	: 1000	: No report	: Reduce to 1/2 A--replant
engelmanni	: 1933	: 303	: 1000	: " "	: Fill in
pungens	: 1933	: 504	: 1000	: Good	: " "
canadensis	: 1933	: 454	: 1000	: Good	: " "
rubra	: 1933	: 101	: 500	: Badly frosted	: Consolidate to 1/10 A
mariana	: 1935	: 58	: 300	: Good	: Reduce to 1/10 A--replant
sitchensis	: 1935	: 73	: 800	: Badly frosted	: Consolidate

Summary of Status of Priest River Arboretum as of 1936 (continued)

Species	Year of first planting	Number: alive fall 1936	2/ Capacity: of block	Condition	Recommended action
<i>Tsuga heterophylla</i>	1936	107	---	:Good	:Reduce to 1/4 A--replant
<i>mertensiana</i>	1935	199	400	:Poor	:Reduce to 1/10 A--replant
<i>canadensis</i>	1934	76	400	:Poor	:Reduce to 1/4 A--replant
<i>Abies</i>					
<i>grandis</i>	1935	none	---	:All died	:Replant
<i>balsamea</i>	1935	83	400	:No report	:Reduce to 1/10 A--replant
<i>nobilis</i>	1933	none	250	:All (75) died	:Eliminate
<i>magnifica v. shastensis</i>	1935	--	---	:No report	:-----
<i>Larix europea</i>	1935	560	1000	:Good	:Fill in
<i>leptolepis</i>	1935	--	---	:No report	:-----
<i>occidentalis</i>	1934	none	1000	:All died--poor stock	:Replant
<i>Thuja plicata</i>	1936	--	---	:No report	:-----
<i>occidentalis</i>	1934	134	500	:No report	:Fill in
<i>orientalis</i>	1935	none	500	:All died	:Eliminate
<i>Chamaecyparis lawsoniana</i>	1935	210	800	:No report	:Reduce to 1/10 A--replant
<i>Cupressus arizonica</i>	1935	none	---	:All died	:Eliminate
<i>macnabiana</i>	1935	none	---	:All died	:Eliminate
<i>Juniperus virginiana</i>	1933	304	500	:Good	:Consolidate
<i>scopulorum</i>	1934	376	500	:Good	:Consolidate
<i>Libocedrus decurrens</i>	1935	--	---	:No report	:-----
<i>Ulmus americana</i>	1933	--	200	:No report <sup>3/</sup>	:-----
<i>Ulmus pumila</i>	1933	--	200	:No report "	:-----
<i>Acer negundo</i>	1933	--	200	:No report "	:-----
<i>Fraxinus pennsylvannica</i>	1933	--	200	:No report "	:-----



Summary of Status of Priest River Arboretum as of 1936 (continued)

Species	: : Year : of first : planting	: : Number: : alive : fall : 1936	: : 2/ : Capacity: : of : block	: : Condition	: : Recommended action
Elaeagnus angustifolia	: 1933	: --	: 200	: No report <sup>3/</sup>	: -----
Caragana arborescens	: 1933	: --	: 200	: No report "	: -----

1/ The only major planting done in 1937 included a new block of Abies magnifica of 650 trees and a replanting of the Libocedrus decurrens block with 840 trees of that species.

2/ The relation between the number alive and the number shown for capacity of the block does not represent the survival because several plantings of fail places were made in nearly all blocks. Although the low survival during the extreme conditions of 1931 to 1935 will mean little as to future possibilities, survival percent can be computed from records of replantings in the Priest River files.

3/ Low survival and damage by deer. See field records at Priest River.

4/ See Memorandum on Arboretum Inspection of Aug. 29, 1935 by R.H. Weidman for details on which recommended action is based.

COMPILATION TABLE -- PRIEST RIVER ARBORETUM <sup>1/</sup>

Block No.	Species	Origin of Seed	Where raised	Trees		First Plantg	Planting fail places				Total planted		Alive			Condition	Recommended action
				No.	Year	No.	No.	Yr.	No.	Yr.	No.	Year	No.	%	Year		
	Pinus ponderosa		Haugan, Montana		1931								515		1936	Good	Fill in fail spots
	"	Bitterroot '28	"		1932												
	"		"		1933												
	"		"		1934												
	jeffreyi		Quincy, Calif.	1200	1933			1933					266		"	Good	Consolidate
	attenuata		San Bernardino, Calif.	50	1933			1933					none		"	All died	Eliminate
	"	So. California	Corvallis, Ore.	500	1935			1935					none		"	"	"
	resinosa		Cass Lake, Minn.	1200	1933			1933					449		"	Fair	Consolidate
	"		"	1000	1934			1934									
	"		"	700	1935			1935									
	austriaca	No. Alps '28	Sault Ste. Marie, Mich	1200	1933			1933					437		"	Half good, half poor	"
	"		Halsey, Neb.	1000	1934			1934									
	"		"	500	1935			1935									
	rigida		Moscow, Ida.	150	1933			1933					275		"	Fair	"
	"	Maine	Mont Alto, Pa.	1000	1935			1935									
	sylvestris		Haugan, Mont.	1200	1932			1932					193		"	Fair	Fill in
	"		"	600	1933			1933									
	"		Halsey, Neb.	500	1934			1934									
	"		Moscow, Ida.	500	1935			1935									
	banksiana		Haugan, Mont.	1200	1932			1932					453		"	Fair	Fill in
	"		"	500	1933			1933									
	"		Halsey, Neb.	300	1934			1934									
	"		Moscow, Ida.	300	1935			1935									
	contorta		"	500	1931			1931					752		"	Fair to good	Fill in
	"		Haugan, Mont.	350	1933			1933									
	"		Monument, Colo.	1000	1934			1934									
	"		Moscow, Ida.	500	1935			1935									
	montana		Haugan, Mont.	1000	1933			1933					337		"	Fair to good	Consolidate
	monticola		"	600	1931			1931					417		"	Fair to poor	Fill in, cultivate
	"		"	1000	1932			1932									
	"		"		1933			1933									
	"		"		1934			1934									
	strobus	Cabinet '27	"														
	"		Haugan, Mont.		1931			1931								Poor, heavy sod	Replant, cultivate
	flexilis		Monument, Colo.	1200	1933			1933					259		"	Fair	Fill in, cultivate
	"		"	500	1935					1935							
	lambertiana		Quincy, Calif.	1000	1933											Poor	Reduce to 1/2 acre, replant
	peuce		Haugan, Mont.	600	1933			1933					371		"	Good	Fill in, cultivate
	"		"	6200	1934			1934		1934							
	aristata		Monument, Colo.	1200	1935			1935									
	edulis		Fort Collins, Colo.	500	1935			1935									
	densiflora		Harrisburg, Pa.					1934					none		"	All died	Eliminate

<sup>1/</sup> This table contains only records available in the Missoula files. The blanks are to be filled in from records in the field files at Priest River. The partially filled-in table is here presented mainly as an example of a compilation form for assembling the records year by year. It is suggested that 5 or 6 lines be reserved for each species to allow for entries on further orders of stock as necessary. These sheets could best be kept in an atlas size folder.

COMPILATION TABLE -- PRIEST RIVER ARBORETUM

Block No.	Species	Origin of seed		Where raised	Trees	Order	First	Plant	Planting		fail places		Total plant'd		Alive		Condition	Recommended Action
					No.	Year	No.	Yr.	No.	Yr.	No.	Yr.	No.	Year	No.	%		
	<i>Pseudotsuga taxifolia</i>	Montana	Cab. '30	Haugan, Mont.	900	1934		1934							468	1936	Good	Fill in
	"	"	"	"														
	"	Colorado	"	Monument, Colo.	1200	1933		1933							242	"	Poor	Consolidate
	"	"	"	"	500	1935				1935								
	"	Washington	Cowlitz	Carson, Wash.	1200	1933		1933							35	"	Fair	Reduce to 1/4 acre and replant
	"	"	Stamania	"	400	1934				1934								
	"	"	Roy	Corvallis, Ore.	500	1935				1935								
	<i>Picea excelsa</i>			Haugan, Mont.	1200	1932		1932							93	"		Reduce to 1/2 acre and replant
	"			"	1000	1933				1933								
	"			Fullman, Wash.	500	1935				1935								
	"			Corvallis, Ore.	900	1935				1935								
	<i>engelmanni</i>			Haugan, Mont.	1200	1933		1933							303	"		Fill in
	<i>pungens</i>			Monument, Colo.	1200	1933									504	"	Good	Fill in
	"			"	200	1934												
	"			Missoula, Mont.	300	1935												
	"	Long Bell Lbr. Co.		Corvallis, Ore.	400	1935												
	<i>canadensis</i>			Haugan, Mont.	1200	1933		1933							454	"	Good	Fill in
	"			Cass Lake, Minn.	1100	1934				1934								
	"			Chequamegon, Wis.	500	1935				1935								
	"			Missoula, Mont.	300	1935				1935								
	"			Corvallis, Ore.	100	1935				1935								
	<i>rubra</i>			Parsons, W. Va.	500	1933		1933							101	"	Badly frosted	Reduce to 1/4 acre
	"			"	400	1934				1934								
	"			Chequamegon, Wis.	200	1935				1935								
	<i>mariana</i>			"	200	1935		1935							58	"	Good	Reduce to 1/4 acre
	<i>sitchensis</i>	Spirit Lake, Wn.		Longview, Wash.	1200	1935		1935							73	"	Badly frosted	Consolidate
	<i>Tsuga heterophylla</i>	Priest River, Ida.		Wildstock, Priest River											107	"	Good	Reduce to 1/4 acre
	<i>menteniana</i>	Snoqualmie Pass, Wn.		Longview, Wash.	1200	1935		1935							199	"	Poor	Reduce to 1/4 acre
	<i>canadensis</i>					1934		1934							76	"	Poor	Reduce to 1/4 acre
	<i>Abies grandis</i>			Longview, Wash.	1200	1935		1935							none	"	All died	Replant
	<i>balsamea</i>			Chequamegon, Wis.	400	1935		1935							83	"		Reduce to 1/4 acre
	<i>nobilis</i>			Haugan, Mont.	75	1931		1931							none	"	All died	Eliminate
	"			"	250	1933		1933							none	"	"	
	<i>magnifica</i>			Susanville, Calif.	650	1937												
	<i>magnifica shastensis</i>	Mt. Shasta, Calif.		Longview, Wash.	1200	1935		1935										
	<i>Larix eurapea</i>			Corvallis, Ore.	2000	1934	2000	1934							none	1936	All died (poor stock)	Fill in
	"			Chequamegon, Wis.	1000	1935		1935							560	"	Good	
	<i>leptolepis</i>	Austria		Corvallis, Ore.	1200	1935												
	<i>occidentalis</i>	Cabinet '30		Haugan, Mont.	2100	1934	2100	1934							none	"	All died (poor stock)	Replant
	<i>Thuja plicata</i>	Priest River, Ida.		Wildstock, Priest River	2000										134	"		Fill in
	<i>occidentalis</i>					1934		1934										
	<i>orientalis</i>			Fullman, Wash.	1200	1935									none	"	All died	Eliminate
	"			Corvallis, Ore.	1200	1935									none	"	"	"
	<i>Chamaecyparis lawsoniana</i>	Marshfield, Ore.		"	1200	1935		1935							210	"		Reduce to 1/4 acre
	<i>Cupressus arizonica</i>			San Bernardino, Calif.	200	1935		1935							none	"	All died	Eliminate
	"			Corvallis, Ore.	1200	1935		1935							none	"	"	"
	<i>macrobiana</i>			San Bernardino, Calif.	200	1935		1935							none	"	"	"
	<i>Libocedrus decurrens</i>			"	500	1935												
	"			Susanville, Calif.	840	1937												
	<i>Juniperus virginiana</i>	Anselmo, Neb.		Halsey, Neb.	600	1933									304	1936	Good	Consolidate
	<i>scopulorum</i>			Monument, Colo.	500	1934									376	"	Good	"

B-Arboretum

## ARBORETUM RECORD

NORTHERN ROCKY MOUNTAIN FOREST & RANGE EXPERIMENT STATION

LOCALITY

Species

Arboretum Block No.

Scientific Name

Common Name

Lot No. (1)	Source of Stock:	Date Received,	Number,	Age or Class,	Size & Condition When Received
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Lot No.	Source of Seed:	Locality,	Lat. & Long.,	Elev.,	Year of Collection,	Collector,	Parentage,	Other Information
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Lot No.	Handling of Stock Before Planting Out:	Dates, Where and How Stored, Etc.
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Lot No.	Stock Held Over in Local Nursery:	When Planted,	Number,	Shading, Etc.
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Lot No.	Planting Record:	Date, Number, Method, Scalping, Condition of Soil, Etc.
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- (1) Separate lots of planting stock numbered 1, 2, 3, etc.  
Separate plantings from same lot numbered 1, 1a, 1b, etc., 2, 2a, 2b, etc.